RESEARCH IMPLEMENTATION REPORT

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Report Date	Report No.	Report Title
January 20, 2006	CCEER 05-11	Recommendations for the Design of Beams and Posts in Bridge Falsework

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Abstract

Recent field observations of bridge Falsework identified potential deficiencies in the design of Falsework resulting in localized bending in sill and cap beam flanges and lateral buckling in other beams. Possible limits states associated with the bearing of timber and steel posts on cap and sill beams are investigated in this report. The critical limit states are related to flange bending, post crushing or yielding, web yielding, web crippling, lateral web buckling and corbel crushing. Different analysis methods are investigated for predicting the capacity of the flange. The first assumes a uniform stress distribution resulting in bending of the flange. This is adequate for timber posts, but not as accurate at the second more elaborate method which accounts for an interaction between flange bending and post compression strength, found to be effective for timber posts. The third method uses an effective bearing area of the post, which is more effective with steel posts. For beams with relatively thick webs, such as those typically used in bridge Falsework, the web was found to have a greater capacity than the flange and posts. The critical web limit state was web yielding (referred to as web crippling in the Caltrans Falsework manual) with variations of existing equations found to be appropriate for predicting the capacity. Web crippling (as defined by AISC) is found to generally not govern the design of falsework beams. Lateral web buckling may govern the design, particularly when two sill beams are stacked on top of each other. Blocking may be used to increase the flange bending and web yielding capacity, although lateral bracing or stiffeners are recommended to increase lateral buckling capacity. Design equations are presented in allowable stress design format for the consideration of the critical limit states in a Falsework bent. These equations are compared to current Caltrans design practice and other relevant specifications. Two design examples are also provided to demonstrate the application of these equations, one using timber posts and a second using steel posts.

Achievement

This project provided an in-depth analysis of the critical limit states of a typical falsework beam to post connection. Lab testing and finite element modeling was performed. Equations were developed to calculate flange bending and lateral web buckling capacities In addition; other recommendations were made to improve falsework design.

Conclusion & Recommendation

The research concluded that flange bending and or lateral web buckling may be the controlling limit state in the design of a falsework bent (reference Table 6-3). Recommendations were made to incorporate new design equations into the California Falsework Manual to check the adequacy of: (1) flange to timber post capacity, (2) corbel to flange capacity, (3) flange to steel post capacity, and (4) lateral web buckling capacity. In addition, recommendations were made to decrease the current timber allowable stress parallel to the grain to a maximum of 1000psi, use AISC allowable stress formulas for the design of a steel pipe post/column, and to rename the web crippling as defined in the California Falsework manual to web yielding.

Contract Manager	Technical Support Team
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Implementation Recommendations

Results and recommendations made in the UNR Report should be reviewed and accepted by Caltrans Falsework experts. Results and recommendations should also be shared and discussed with the industry Falsework experts. Appropriate changes should be made to both the California Falsework Manual and the Caltrans Standard Specifications.

Implementation Measures Taken

Currently in progress as stated above.